Federal Aviation Administration – Regulations and Policies
Aviation Rulemaking Advisory Committee

General Aviation Certification and Operations Issue Area
Fuel Indicators Working Group

Task 1 – Differential Fuel Pressure Transducer Flow-Indicating Devices

Task Assignment

Aviation Rulemaking Advisory Committee; General Aviation and Business Airplane Subcommittee; Fuel Indicators Working Group

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of establishment of Fuel Indicators Working Group.

SUMMARY: Notice is given of the establishment of a Fuel Indicators Working Group by the General Aviation and Business Airplane Subcommittee. This notice informs the public of the activities of the General Aviation and Business Airplane Subcommittee of the Aviation Rulemaking Advisory Committee.

FOR FURTHER INFORMATION CONTACT: Mr. William J. (Joe) Sullivan, Executive Director, General Aviation and Business Airplane Subcommittee, Aircraft Certification Service (AIR-3), 800 Independence Avenue, SW., Washington, DC 20591, Telephone: (202) 267-9554; FAX: (202) 267-9562.

SUPPLEMENTARY INFORMATION: The Federal Aviation Administration (FAA) established an Aviation Rulemaking Committee (56 FR 2190, January 22, 1991) which held its first meeting on May 23, 1991 (56 FR 20492, May 3, 1991). The General Aviation and Business Airplane Subcommittee was established at that meeting to provide advice and recommendations to the Director, Aircraft Certification Service, FAA, regarding the airworthiness standards for standard and commuter category airplanes and engines in part 23 of the Federal Aviation Regulations, and parallel provisions of parts 91 and 135 of the Federal Aviation Regulations. At its first meeting on November 5, 1991 (56 FR 54505; October 22, 1991) the subcommittee established the Fuel Indicators Working Group. Specifically, the working group's task is the following:

Task

The Fuel Indicators Working Group is charged with making a recommendation to the General Aviation and Business Airplane Subcommittee concerning disposition of the Aircraft Owners and Pilots Association (AOPA) petition for rulemaking dated July 16, 1990, requesting amendments to § 23.1305(g) of the Federal Aviation Regulations (Docket No. 26281) to allow use of differential fuel pressure transducer flow-indicating devices. In completing this task, the working group should review comments received in response to this petition.

Reports

The working group will develop any combination of the following as it deems appropriate:

1. A draft Notice of Proposed Rulemaking proposing the requested or modified new standards, supporting economic and other required analysis, and any other collateral documents the working group determines are needed; or

2. A Denial of Petition stating the rationale for not adopting the new standards proposed in the petition.

The working group chair or an alternate should: (a) Recommend organizational structure(s) and time line(s) for completion of this effort, including rationale, for subcommittee consideration at the meeting scheduled for January 29, 1992; (b) give a status report on this task at each meeting of the subcommittee; and (c) give a detailed conceptual presentation to the subcommittee before proceeding with the drafting of documents described in paragraphs 1 and 2 above.

The Fuel Indicators Working Group will be comprised of experts from those organizations having an interest in the task assigned to it. A working group member need not be a representative of one of the organizations of the parent General Aviation and Business Airplane Subcommittee or of the full Aviation Rulemaking Advisory Committee. An individual who has expertise in the subject matter and wishes to become a member of the working group should write to the person listed under the caption **FOR FURTHER INFORMATION CONTACT** expressing that desire, describing his or her interest in the task, and stating the expertise he or she would bring to the working group. The request will be reviewed with the subcommittee chair and working group leader; and the individual will be advised whether or not the request can be accommodated.

The Secretary of Transportation has determined that the information and use of the Aviation Rulemaking Advisory Committee and its subcommittees are necessary in the public interest in connection with the performance of duties imposed on the FAA by law. Meetings of the full committee and any subcommittees will be open to the public except as authorized by section 10(d) of the Federal Advisory Committee Act. Meetings of the Fuel Indicators Working Group will not be open to the public, except to the extent that individuals with an interest and expertise are selected to participate. No public announcement of working group meetings will be made.

Issued in Washington, DC, on January 3, 1992.

William J. Sullivan,

Executive Director, General Aviation and Business Airplane Subcommittee, Aviation Rulemaking Advisory Committee.

[FR Doc. 92-756 Filed 1-10-92; 8:45 am]

BILLING CODE 4910-13-M

Recommendation Letter

208 Patterson Street
Falls Church, VA 22046
February 15, 1994

Mr. Anthony J. Broderick, AVR-1
Associate Administrator for
Regulation and Certification
Federal Aviation Administration
800 Independence Ave., SW, Room 1000 West
Washington, D. C. 20591

Dear Mr. Broderick,

I attach for attention a Draft NPRM and Draft Advisory Circular and associated documents relating to powerplant instruments; fuel pressure indication.

Following completion by the working group, these documents were reviewed by the General Aviation and Business Airplane Issues Group who have approved them and recommend they be forwarded to the FAA for appropriate action.

I would request that you proceed as necessary

Yours sincerely,

Bernard B. Brown
Assistant Chair for General Aviation and
Business Airplane Issues

EXECUTIVE SUMMARY

TITLE: Notice of Proposed Rulemaking (NPRM); Powerplant Instruments; Fuel Pressure Indication

SUMMARY: This notice proposes to amend the certification requirement for fuel pressure indicators on pump-fed engines to permit other alternatives to warn pilots of imminent fuel pressure loss. A fuel pressure indicator is not the only means currently available in the marketplace to warn the pilot of a fuel pump failure. The proposed change would allow manufacturers to utilize new technology to improve operation, economy, and engine life. With these goals met, engine reliability and longevity will improve, resulting in increased safety.

BACKGROUND: AOPA petitioned for new standards that would allow, on all pump-fed engines, a fuel flow system employing a differential pressure transducer to be accepted as an equivalent means of compliance to the current fuel pressure indicator requirements. Following receipt of AOPA's petition for rulemaking, the FAA requested that the Aviation Rulemaking Advisory Committee (ARAC) review the petition. The ARAC recommended that the FAA revise the certification standards for fuel pressure indicators. The ARAC working group agreed with AOPA's petition but feels the language is too restrictive. Major technical advances in the auto industry with engine systems and controls may offer improvements over the current warning systems. Avenues should be open allowing this ever-evolving technology to be used. The working group proposed wording that would allow the use of any system offering the pilot advance warning of a fuel pump failure.

WHO WOULD BE AFFECTED: Manufacturers and modifiers of part 23 airplanes.

SIGNIFICANT ISSUES: The Aviation Rulemaking Advisory Committee (ARAC) and industry have expressed a need for a revised airworthiness certification standard for fuel pressure indication to warn the pilot of a fuel pump failure in part 23 airplanes. This need would be addressed by the change proposed here.

COSTS AND BENEFITS: The proposed rule change would provide an equivalent or improved level of safety without involuntarily imposing new requirements or costs on aircraft manufacturers by allowing, not requiring, alternative means of warning pilots of fuel pressure loss. To the extent that it would encourage the development and utilization of comprehensive engine control, monitoring and diagnostic systems, it would contribute further benefits in the form of enhanced safety and improved fuel efficiency, power output, and engine life.

ENERGY IMPACT: The energy impact of the notice of proposed rulemaking has been assessed in accordance with the Energy Policy and Conservation Act (EPCA), P.L. 94-163, and Interim Agency

Acknowledgement Letter

U.S. Department
of Transportation
**Federal Aviation
Administration**

800 Independence Ave., S.W.
Washington, D.C. 20591

MAR 8 1994

Mr. Bernard D. Brown
Assistant Chair, General Aviation and
Business Airplanes Issues
208 Patterson Street
Falls Church, VA 22046

Dear Mr. Brown:

Thank you for your February 15 letter with which you transmitted recommendations of the Aviation Rulemaking Advisory Committee (ARAC) Fuel Indicators Working Group. The ARAC recommends that the Powerplant Instruments; Fuel Pressure Indication Notice of Proposed Rulemaking (NPRM) be completed and processed, and revisions to Advisory Circular 23.1305-X be made. The Federal Aviation Administration (FAA) accepts these recommendations provided there are no legal or other reasons why we cannot adopt them.

The complete rulemaking package will be reviewed and coordinated within the FAA and other appropriate offices. The FAA will publish the NPRM and a notice of availability of the proposed advisory circular for public comments simultaneously.

These recommendations have become a very high priority within the Aircraft Certification Service, and will be handled expeditiously.

I would like to thank the ARAC, and particularly the Fuel Indicators Working Group, for its prompt action on the task that the FAA imposed.

Sincerely,

Anthony J. Broderick
Associate Administrator for
Regulation and Certification

Guidelines. It has been determined that the notice of proposed rulemaking is not a major regulatory action under the provisions or the EPCA.

ENVIRONMENTAL IMPACT: The environmental impact of this notice of proposed rulemaking has been assessed in accordance with FAA Order 1050.1D, and it has been determined that the notice of proposed rulemaking is not a major Federal Action significantly affecting the environment.

Recommendation

U.S. Department
of Transportation

FEDERAL AVIATION
ADMINISTRATION

Washington, D.C. 20591

PRELIMINARY REGULATORY EVALUATION, INITIAL REGULATORY FLEXIBILITY DETERMINATION AND TRADE IMPACT ASSESSMENT

for the NPRM concerning

POWERPLANT INSTRUMENTS: FUEL PRESSURE INDICATION 14 CFR PART 23

OFFICE OF AVIATION POLICY, PLANS, AND MANAGEMENT ANALYSIS
Aircraft Regulatory Analysis Branch, APO-320

Charles A. Aiken
February 1993

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I. INTRODUCTION

This regulatory evaluation examines the impacts of a proposed change to part 23 of the Federal Aviation Regulations. The proposed rule would revise § 23.1305(g), the certification requirement for fuel pressure indicators on pump-fed engines, by allowing alternative means of warning pilots of fuel pressure loss.

II. BACKGROUND

The original intent of the fuel pressure indication requirement (adopted in 1949) was to warn pilots of fuel pressure deficiencies before total engine failure occurred. Although fuel pressure indicators have proven effective, their benefits have diminished over the years with the introduction of more reliable fuel pumps, decreasing fuel pump failures, and the utilization of emergency fuel pumps in addition to the main fuel pump.

Past policy has resulted in confusion over what are acceptable and unacceptable means of fuel system monitoring, including indication and location of the pressure pick-up. In some installations utilizing a constant pressure pump, a differential pressure indicator measuring unmetered fuel pressure has been required at the fuel pump output. On the other hand, installations using a speed-sensing integral pump system have been approved with a fuel pressure indicator measuring metered fuel pressure at the fuel distribution valve. Airplanes utilizing this system have a fuel pressure indicator calibrated in fuel flow. Policy has allowed fuel indicators measuring metered fuel flow to be used as an equivalent means of compliance if the engine is certified with an

integral speed-sensing pressure pump and differential pressure is used for the measurement.

In recognition of this background and the fact that conventional fuel indicators are no longer the sole warning means of fuel pressure deficiencies, the Aircraft Owners and Pilots Association (AOPA) petitioned the FAA in July 1990 for a revised standard that would allow a fuel flow system employing a differential pressure transducer as an equivalent means of compliance. AOPA believes that this change would facilitate the development of new engine monitoring systems and could potentially reduce the instrument panel clutter that is common in today's general aviation aircraft.

The FAA requested the Aviation Rulemaking Advisory Committee (ARAC) to evaluate AOPA's petition and recommend a disposition to the FAA. The ARAC was chartered in February 1991, under the Federal Advisory Committee Act, to provide recommendations to the FAA Administrator on rulemaking relating to aviation safety issues.

Based on a review of the petition by the Fuel Indicators Working Group of its General Aviation and Business Airplane Subcommittee, ARAC recommends that the FAA revise the standard. While agreeing with the spirit of AOPA's petition, ARAC feels it is too restrictive. Citing technical advances and evolving technologies in engine control, monitoring, and diagnostic systems that offer many improvements over conventional warning systems, ARAC recommends acceptance of any system that provides effective advance warning of fuel pump failure.

III. ECONOMIC ANALYSIS

Because the proposed rule change would be optional by permitting, but not requiring, alternative means of warning pilots of fuel pressure loss, it would provide an equivalent or improved level of safety without involuntarily imposing new requirements or costs on aircraft manufacturers. On this basis, the FAA finds it to be cost-beneficial. To the extent that it would encourage the development and utilization of comprehensive engine control, monitoring and diagnostic systems, it would contribute further benefits in the form of enhanced safety and improved fuel efficiency, power output, and engine life.

IV. REGULATORY FLEXIBILITY DETERMINATION

The Regulatory Flexibility Act (RFA) of 1980 was enacted by Congress to ensure that small entities are not unnecessarily or disproportionately burdened by Government regulations. The RFA requires a Regulatory Flexibility Analysis if a rule is expected to have a "significant (positive or negative) economic impact on a substantial number of small entities." Based on the standards and thresholds of implementing FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, the FAA has determined that the proposed rule would not have a significant impact on a substantial number of small aircraft manufacturers.

V. TRADE IMPACT ASSESSMENT

The proposed rule change would have no impact on the sale of United States products in foreign markets or the sale of foreign products in the United States.

FOR INSERTION INTO THE PREAMBLE

OF THE NPRM

CONCERNING

POWERPLANT INSTRUMENTS: FUEL PRESSURE INDICATION

FEBRUARY, 1993

Regulatory Evaluation Summary

Three requirements pertain to economic impacts of regulatory changes to the FARs. First, Executive Order 12291 directs Federal agencies to promulgate new regulations or modify existing regulations only if the potential benefits to society outweigh the potential costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Finally, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this rule: 1) would generate benefits exceeding costs and is neither major as defined in the Executive Order nor significant as defined in DOT's Policies and Procedures; 2) would have no significant impact on a substantial number of small entities; and 3) would have no impact on international trade. These analyses, available in the docket, are summarized below.

Benefits and Costs

Because the proposed rule change would be optional by permitting, but not requiring, alternative means of warning pilots of fuel pressure loss, it would provide an equivalent or improved level of safety without involuntarily imposing new requirements or costs on aircraft manufacturers. On this basis, the FAA finds it to be cost-beneficial. To the extent that it would encourage the development and utilization of comprehensive engine control, monitoring and diagnostic systems, it would contribute further benefits in the form of enhanced safety and improved fuel efficiency, power output, and engine life.

Regulatory Flexibility Determination

The Regulatory Flexibility Act (RFA) of 1980 was enacted by Congress to ensure that small entities are not unnecessarily or disproportionately burdened by Government regulations. The RFA requires a Regulatory Flexibility Analysis if a rule is expected to have a "significant (positive or negative) economic impact on a substantial number of small entities." Based on the standards and thresholds of implementing FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, the FAA has determined that the proposed rule would not have a significant impact on a substantial number of small aircraft manufacturers.

Trade Impact Assessment

The proposed rule change would have no impact on the sale of United States products in foreign markets or the sale of foreign products in the United States.

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

DRAFT

Subject: FUEL PUMP FAILURE WARNING IN PART 23 AIRPLANES

Date: MAR 18 1993
Initiated by: ACE-100

AC No: 23.1305-X
Change:

1. PURPOSE. This advisory circular (AC) sets forth an acceptable means, but not the only means, of showing compliance with § 23.1305(g) of the Federal Aviation Regulations (FAR), applicable to pilot warning of imminent fuel pump failure in part 23 airplanes. Accordingly, this material is neither mandatory nor regulatory in nature and does not constitute a regulation.

2. RELATED REGULATIONS. Listed below are the applicable FAR sections:

§ 23.955 - Fuel flow
§ 23.961 - Fuel system hot weather operation
§ 23.991 - Fuel pumps
§ 23.993 - Fuel system lines and fittings
§ 23.1183 - Lines, fittings, and components
§ 23.1305 - Powerplant instruments, General
§ 23.1322 - Warning, caution, and advisory lights
§ 23.1337 - Powerplant instruments, Instruments: Installation
§ 23.1529 - Instructions for Continued Airworthiness
§ 23.1541 - Markings and Placards, General
§ 23.1543 - Instruments markings: General
§ 23.1549 - Powerplant instruments

3. BACKGROUND. The first document requiring a fuel pressure indicator was Civil Air Regulations (CAR) 4b, the predecessor to part 25 for transport aircraft. The requirement for fuel pressure indication applied to all large reciprocating engine airplanes. CAR 3 amendment 3-4, dated November 1, 1949, for small airplanes, required fuel pressure indicators be installed on airplanes with pump-fed engines. Many small airplanes of the era used gravity-fed fuel systems, which made a fuel pressure indication unnecessary. Also, a fuel pressure indication was not required if the fuel pump was certified as part of the engine. Since early fuel pumps were less reliable by today's standards, the intent of the requirement was to offer the pilot advanced warning of a fuel pump failure. Another reason for the requirement was to provide the pilot with diagnostic capability.

Horizontally opposed engines gained popularity and grew in displacement, evolving in two different types of fuel injection systems. These two systems are still predominant today. One consists of a fuel injector/metering unit that relies on a separate pump to supply fuel to the injector. This pump is referred to as a constant pressure pump. Since the metering (regulating) is done at the injector, fuel pressure is not critical and any pump that provides a specific range of pressures is adequate. If the injector has a 20 pound per square inch (psi) requirement, 23-30 psi pump pressure is acceptable because the fuel pressure on the outlet side of the injector is 20 psi. If the pressure out of the pump falls below 20 psi, the injector will fail to provide adequate fuel to the engine.

The second fuel injection system uses the fuel pump as an integral member of the system. This pump is referred to as an integral speed-sensing pressure pump. It delivers fuel at a pressure proportional to engine speed. Any change in pump pressure results in a change in engine operation.

Past policy has resulted in confusion over what is acceptable for fuel system monitoring, including indication and location of the pressure pick-up. In some installations utilizing the constant pressure pump, a differential pressure gauge measured unmetered fuel pressure at the fuel pump output. A differential pressure gauge measures the difference between the pressure of the fuel at the carburetor inlet and the pressure of the air at the carburetor upper deck. On the other hand, engine installations using the integral speed-sensing pressure pump have been approved with a fuel flow indicator measuring metered fuel pressure at the fuel distribution valve. Airplanes utilizing this system have a fuel pressure indicator calibrated in fuel flow. Policy has allowed fuel indicators measuring metered fuel flow to be used as an equivalent means of compliance if the engine was certified with an integral speed-sensing pressure pump and differential pressure was used for the measurement.

4. DISCUSSION. The original intent of the fuel pressure indicator requirement for pump-fed engines was to advise the pilot of a fuel pressure deficiency before total engine failure. Modern reciprocating engines use more reliable fuel pumps than those built in the 40's and 50's. Today, airplane owners are concerned about ways of extending the life of their engines and operating them economically; fuel pump failures are not as frequent. Furthermore, all pump-fed engines utilizing separate (not certified with the engine) fuel pumps must have an emergency fuel pump in addition to the main fuel pump. Reciprocating engines run better and last longer if the fuel to air mixture is leaned out as recommended by the manufacturer. Although leaning should always be done by referencing the exhaust gas temperature (EGT), fuel flow is often specified for engine operations. In these cases, fuel flow should be compared to the EGT setting. Fuel flow also relates to power, which pilots can use to quickly assess the condition of their

engine. Therefore, pilots prefer to monitor fuel flow more than fuel pressure for engine information, performance, and engine life.

5. ACCEPTABLE MEANS OF COMPLIANCE. Carbureted engines are included in the regulation, even though they have not been mentioned before now. Historically, carbureted engines used fuel pumps that were certified with the engine and, therefore, did not require the indicator. Since other arrangements may be used in the future, the definition of "pump-fed" needs to be clear. Pump-fed refers to a pump system not certified as part of the engine, that delivers fuel to the engine not including emergency fuel pumps.

Confusion with means of complying with the fuel pressure indicator requirement stems from the different types of injection systems manufactured. The fuel pressure indicator requirement was meant to measure the unmetered fuel pressure at the output of the pump. The solution was easy in a system using a constant pressure pump. Install the fuel pressure pick-up at the pump output. The indicator displays the actual pump output versus the fuel the engine uses, and the pilot can see fuel pump degradation prior to seeing a change in engine operation. A fuel flow gauge could also offer advanced warning of fuel pump failure, but unmetered fuel flow information does not represent the actual fuel the engine is burning. This can occur because the unmetered fuel could flow at 20 gallons/hour while the engine is really using 15 gallons/hour. The excess fuel is returned to the fuel tank. Replacing a fuel pressure indicator with a fuel flow indicator on the unmetered side of the injector provides no new information, invites confusion, and decreases safety.

In a system using an integral speed-sensing pressure pump, the installation becomes more confusing. The fuel pump is driven directly by the engine and is sensitive to revolutions per minute (RPM). Any change in pump output results in a change in engine operation. In this system, installing the fuel pressure pick-up at the pump output measures metered fuel flow. Although this reading has normal operation and diagnostic value to the pilot, in the event of an engine failure, no advanced warning is provided because the engine responds to fuel fluctuations within seconds of the gauge indication. In this case, the fuel pressure or fuel flow indication does not meet the intent of the requirement because metered fuel flow does not offer advanced warning of pump failure. Therefore, a fuel pressure or flow indication is not required on engines using these fuel injection systems.

BARRY D. CLEMENTS
Manager, Small Airplane Directorate
Aircraft Certification Service

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No. ; Notice No.]

RIN: 2120-

Powerplant Instruments; Fuel Pressure Indication

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This notice proposes to amend the certification requirement for fuel pressure indicators on pump-fed engines to permit other regulatory alternatives to warn pilots of imminent fuel pressure loss. A fuel pressure indicator is not the only means currently available in the marketplace to warn the pilot of a fuel pump failure. The proposed change would allow manufacturers to utilize new technology to improve operation, economy, and engine life. With these goals met, engine reliability and longevity will improve, resulting in increased safety.

DATES: Comments must be received on or before (60 days after publication in the Federal Register.)

ADDRESSES: Comments on this notice should be mailed in triplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket (AGC-10), Docket No. , 800 Independence Avenue SW., Washington, DC 20591. Comments delivered must be marked Docket No. . Comments may be

inspected in room 915G weekdays between 8:30 a.m. and 5 p.m., except on Federal holidays.

In addition, the FAA is maintaining an information docket of comments in the Office of the Assistant Chief Counsel, ACE-7, Federal Aviation Administration, Central Region, 601 East 12th Street, Kansas City, Missouri 64106. Comments in the information docket may be inspected in the Office of the Assistant Chief Counsel weekdays, except Federal holidays, between the hours of 7:30 a.m. and 4 p.m.

FOR FURTHER INFORMATION CONTACT: J. Lowell Foster, Standards Office (ACE-112), Small Airplane Directorate, Aircraft Certification Service, Federal Aviation Administration, 601 East 12th Street, Kansas City, Missouri 64106; telephone (816) 426-5688.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in the making of the proposed rule by submitting such written data, views, or arguments as they may desire. Comments relating to the environmental, energy, or economic impact that might result from adopting the proposals in this notice are also invited. Substantive comments should be accompanied by cost estimates. Comments should identify the regulatory docket or notice number and should be submitted in triplicate to the Rules Docket address specified above. All comments received on or before the closing

date for comments specified will be considered by the Administrator before taking action on this proposed rulemaking. The proposals contained in this notice may be changed in light of comments received. All comments received will be available, both before and after the closing date for comments, in the Rules Docket for examination by interested persons. A report summarizing each substantive public contact with Federal Aviation Administration (FAA) personnel concerned with this rulemaking will be filed in the docket. Commenters wishing the FAA to acknowledge receipt of their comments submitted in response to this notice must include a preaddressed, stamped postcard on which the following statement is made: "Comments to Docket No. ." The postcard will be date stamped and mailed to the commenter.

Availability of NPRM

Any person may obtain a copy of this NPRM by submitting a request to the Federal Aviation Administration, Office of Public Affairs, Attention: Public Inquiry Center, APA-200, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267-3484. Communications must identify the notice number of this NPRM.

Persons interested in being placed on the mailing list for future NPRMs should request, from the above office, a copy of Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

Statement of the Problem

The FAA proposes to amend Federal Aviation Regulation (FAR) § 23.1305(g) allowing alternative means of compliance to certification standards for fuel pressure indicators. Requiring a fuel pressure indicator on airplanes powered by pump-fed engines does not reflect the sole means of compliance available to the general aviation market today. Engine sensor developments necessitate broadening the scope of the regulation such that the new technology can be incorporated in small airplanes, improving the level of safety and possibly reducing the costs.

History

The first regulatory requirement for a fuel pressure indicator was Civil Air Regulation (CAR) 4b, the predecessor to part 25 of the FAR for transport aircraft. That requirement applied to all reciprocating engine airplanes. CAR 3, the predecessor to part 23 of the FAR, amendment 1, adopted December 15, 1946, for light airplanes, required fuel pressure indicators on airplanes with pump-fed engines. Many small airplanes of that era used gravity-fed fuel systems, which made a fuel pressure indication unnecessary. Also, a fuel pressure indication was not required if the fuel pump was certified as part of the engine. Since early fuel pumps were less reliable, the intent of the CAR requirements was to provide the pilot with

advance warning of a fuel pump failure and the diagnostic capability to prevent engine failure.

As horizontally opposed engines gained popularity and grew in displacement, two different types of fuel injection systems emerged. One consisted of a fuel injector/metering unit that relied on a separate constant pressure pump to supply fuel to the injector. Since the metering (regulating) was done at the injector, the fuel pressure required was not critical and any pump that could provide a specific range of pressures was adequate. If the injector had a 20 psi requirement, 23-30 psi pump pressure was acceptable because the fuel pressure on the outlet side of the injector was 20 psi. If the pressure out of the pump fell below 20 psi, the injector would fail to provide adequate fuel to the engine.

The second fuel injection system used an integral speed-sensing pressure fuel pump as an component of the system. It delivered fuel at a pressure proportional to engine speed. Any change in pump pressure resulted in a change in engine operation.

Regulatory interpretation resulted in confusion over what was acceptable for fuel system monitoring, including indication and location of the pressure pick-up. Some installations utilizing the constant pressure pump required a differential pressure indicator measuring unmetered fuel pressure at the fuel pump output. On the other hand, installations using the speed-sensing integral pump system have been approved with a fuel pressure indicator measuring metered fuel pressure at the fuel

distribution valve. Airplanes utilizing this system have a fuel pressure indicator calibrated in fuel flow. Policy allowed fuel indicators measuring metered fuel flow to be used as an equivalent means of compliance if the engine was certified with an integral speed-sensing pressure pump and differential pressure was used for the measurement.

The Aircraft Owners and Pilots Association (AOPA) petitioned the FAA for new standards that would allow, on all pump-fed engines, a fuel flow system employing a differential pressure transducer to be accepted as an equivalent means of compliance to the current fuel pressure indicator requirements. The AOPA believes that this action would open the door for the development of new and valuable engine monitoring equipment, while potentially reducing the instrument panel clutter.

Following receipt of AOPA's petition for rulemaking, the FAA requested that the Aviation Rulemaking Advisory Committee (ARAC) review the petition and recommend a disposition to the FAA. The ARAC was chartered in February 1991, under the Federal Advisory Committee Act, to provide recommendations to the FAA Administrator on FAA rulemaking activity relating to aviation safety issues.

In January 1992, the Fuel Indicators Working Group of the ARAC's General Aviation and Business Airplane Issues Group reviewed AOPA's petition. The working group and, subsequently, the ARAC issues group, recommended that the FAA revise the certification standards for fuel pressure indicators. The

working group agrees with AOPA's petition but feels the language is too restrictive. Major technical advances in the auto industry with engine systems and controls may offer improvements over the current warning systems. Avenues should be open allowing this ever-evolving technology to be used. The working group proposed wording that would allow the use of any system offering the pilot advance warning of a fuel pump failure.

General Discussion of the Proposals

The original intent of the fuel pressure indicator requirement for pump-fed engines was to advise the pilot of a fuel pressure deficiency before total engine failure. Modern reciprocating engines utilize more reliable fuel pumps than those built in the 40's and 50's. Today, airplane owners are concerned about ways to extend the life of their engines as well as operating them economically. Furthermore, all pump-fed engines utilizing separate (not certified as part of the engine) fuel pumps must have an emergency fuel pump in addition to the main fuel pump. Reciprocating engines run better and last longer if the fuel to air mixture is leaned out according to the manufacturers' specified setting. Often, a fuel flow is specified for engine operations; therefore, pilots are interested in fuel flow more than fuel pressure when optimizing engine performance and engine life. Fuel flow also relates to power and pilots can use fuel flow to quickly assess the health of their engine.

Comprehensive engine monitors and redesigned electronic engine instrument displays are already being used in experimental aircraft. Though benefits of the new approaches to engine monitoring are still unknown, the FAA should allow airplane manufacturers to utilize new technology to improve operation, economy, and engine life. New engine monitoring systems may improve reliability and engine life, resulting in increased safety.

Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1990 (44 U.S.C. 3501 et seq.), there are no reporting or recordkeeping requirements associated with this proposed rule.

Regulatory Evaluation Summary

Three requirements pertain to economic impacts of regulatory changes to the FARs. First, Executive Order 12291 directs Federal agencies to promulgate new regulations or modify existing regulations only if the potential benefits to society outweigh the potential costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Finally, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this rule: 1) would generate benefits exceeding costs and is neither major as defined

in the Executive Order nor significant as defined in DOT's Policies and Procedures; 2) would have no significant impact on a substantial number of small entities; and 3) would have no impact on international trade. These analyses, available in the docket, are summarized below.

Benefits and Costs

Because the proposed rule change would be optional by permitting, but not requiring, alternative means of warning pilots of fuel pressure loss, it would provide an equivalent or improved level of safety without involuntarily imposing new requirements or costs on aircraft manufacturers. On this basis, the FAA finds it to be cost-beneficial. To the extent that it would encourage the development and utilization of comprehensive engine control, monitoring and diagnostic systems, it would contribute further benefits in the form of enhanced safety and improved fuel efficiency, power output, and engine life.

Regulatory Flexibility Determination

The Regulatory Flexibility Act (RFA) of 1980 was enacted by Congress to ensure that small entities are not unnecessarily or disproportionately burdened by government regulations. The RFA requires a Regulatory Flexibility Analysis if a rule is expected to have a "significant (positive or negative) economic impact on a substantial number of small entities." Based on the standards and thresholds of implementing FAA Order 2100.14A, Regulatory

Flexibility Criteria and Guidance, the FAA has determined that the proposed rule would not have a significant impact on a substantial number of small aircraft manufacturers.

International Trade Impact Analysis

The proposed rule change would have no impact on the sale of United States products in foreign markets or the sale of foreign products in the United States.

Federalism Implications

The regulations proposed herein would not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this proposal would not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

The FAA proposes to amend the airworthiness standards to allow airplane manufacturers to utilize new technology for fuel pump monitoring to improve the operation, economy, and engine life of part 23 airplanes powered by pump-fed engines. The current requirements provide for a fuel pressure indication that warn the pilot of an imminent pump failure but limit the means of

compliance. The dramatic advances in auto engine systems and electronics offer technology that should be utilized by the aviation community. By broadening this airworthiness standard, new engine monitoring systems may be utilized that will improve reliability, lower operating costs, and increase safety.

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this proposed regulation is not major under Executive Order 12291. In addition, the FAA certifies that this proposal, if adopted, will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. This proposal is not considered significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). An initial regulatory evaluation of the proposal, including a Regulatory Flexibility Determination and Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under "FOR FURTHER INFORMATION CONTACT."

List of Subjects in 14 CFR Part 23

Aircraft, Air transportation, Aviation safety, Safety.

THE PROPOSED AMENDMENT

In consideration of the foregoing, the Federal Aviation Administration proposes to amend part 23 of the Federal Aviation

Regulations (14 CFR part 23) as follows:

PART 23--AIRWORTHINESS STANDARDS: NORMAL, UTILITY, ACROBATIC, AND COMMUTER CATEGORY AIRPLANES

1. The authority citation for part 23 continues to read as follows:

Authority: 49 U.S.C. 1344, 1354(a), 1355, 1421, 1423, 1425, 1428, 1429, 1430, 49 U.S.C. 106(g).

2. Section 23.1305 is amended by revising paragraph (g) to read as follows:

§ 23.1305 Powerplant instruments.

* * * * *

(g) A means to indicate imminent loss of fuel pressure for each pump-fed engine.

* * * * *

Issued in Washington D.C. on

FAA Action

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No. 28011; Notice No. 94-37]

RIN 2120-AF41

Powerplant Instruments; Fuel Pressure Indication

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This document proposes to amend the certification requirement for fuel pressure indicators on pump fed engines of small airplanes to permit regulatory alternatives to warn pilots of fuel system problems. A fuel pressure indicator is not the only means available to the pilot of indicating a fuel system problem. The proposed change would allow airplanes to be certificated with means that indicate fuel flow, or that monitor the fuel system and warn the pilot of a trend that could lead to engine failure. New technology that would be incorporated as means of compliance with the revised rule could improve engine operation and reduce airplane operating costs.

DATES: Comments must be received on or before February 27, 1995.

ADDRESSES: Comments on this document should be mailed in triplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket (AGC-10), Docket No. 28011, 800 Independence Avenue SW., Washington, DC 20591. Comments delivered must be marked Docket No. 28011. Comments may be inspected in room 915G weekdays between 8:30 a.m. and 5 p.m., except on Federal holidays.

In addition, the FAA is maintaining an information docket of comments in the Office of the Assistant Chief Counsel, ACE-7, Federal Aviation Administration, Central Region, 601 East 12th Street, Kansas City, Missouri 64106. Comments in the information docket may be inspected in the Office of the Assistant Chief Counsel weekdays, except Federal holidays, between the hours of 7:30 a.m. and 4 p.m.

FOR FURTHER INFORMATION CONTACT: J. Lowell Foster, Standards Office, Small Airplane Directorate, Aircraft Certification Service, Federal Aviation Administration, 601 East 12th Street, Kansas City, Missouri 64106; telephone (816) 426-5688.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in the making of the proposed rule by submitting such written data, views, or arguments as they may desire. Comments relating to the environmental, energy, or economic impact that might result from adopting the proposals in this notice are also invited. Substantive comments should be accompanied by cost estimates. Comments should identify the regulatory docket or notice number and should be submitted in triplicate to the Rules Docket address specified above. All comments received on or before the closing date for comments specified will be considered by the Administrator before taking action on this proposed rulemaking. The proposals contained in this notice may be changed in light of comments received. All comments received will be available, both before and after the closing date for comments, in the Rules Docket for examination by interested persons. A report summarizing each substantive public contact with Federal Aviation Administration (FAA) personnel concerned with this rulemaking will be filed in the docket. Commenters wishing the FAA to acknowledge receipt of their comments submitted in response to this notice must include a preaddressed, stamped postcard on which the following statement is made: "Comments to Docket No. 28011." The postcard will be date stamped and mailed to the commenter.

Availability of NPRM

Any person may obtain a copy of this NPRM by submitting a request to the Federal Aviation Administration, Office of Public Affairs, Attention: Public Inquiry Center, APA-200, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267-3484. Communications must identify the notice number of this NPRM.

Persons interested in being placed on the mailing list for future NPRMs should request, from the above office, a copy of Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

Statement of the Problem

The FAA proposes to amend Title 14 of the Code of Federal Regulations (CFR), § 23.1305(b)(4), which currently requires a fuel pressure indicator for each pump fed engine. The pressure indicator gives continuous fuel pressure readings to the pilot. This information provides an advance warning of engine failure only when a pilot notices that the pressure reading has deviated from the norm, and the pilot can diagnose what those deviations mean in terms of potential engine failure. This proposal would allow the options of a fuel pressure indicator, a fuel flow indicator, or a means that continuously monitors the fuel system and warns the pilot of any engine trend that could cause engine failure. A fuel flow indicator would give continuous fuel flow readings to the pilot; fuel flow information can be more meaningful to the pilot during critical phases of flight. The proposed continuous fuel system monitoring would alert the pilot to any trend that could lead to engine failure.

History

The first requirement for a fuel pressure indicator was found in Civil Air Regulation (CAR) 4b, the predecessor to part 25 of Title 14 for transport airplanes. That requirement applied to all reciprocating engine airplanes. CAR 3, applicable to small airplanes, followed CAR 4b and was the predecessor to part 23 of Title 14. Amendment 1 to CAR 3, adopted December 15, 1946, required fuel pressure indicators on airplanes with pump-fed engines. Many small airplanes of that era used gravity-fed fuel systems, which made a fuel pressure indication unnecessary. Also, a fuel pressure indication was not required if the fuel pump was certificated as part of the engine. Since early fuel pumps were less reliable, the intent of the CAR requirements was to provide the pilot with advance warning of a fuel pump failure. This allowed the pilot to diagnose the problem and prevent engine failure or determine the cause after the engine quit.

Engines of the CAR 3 era were designed with carburetors. Carburetors were replaced by fuel injection. At the same time, radial engines were being replaced with horizontally opposed engines, the configurations currently used in the majority of light airplanes.

As horizontally opposed engines gained popularity and grew in displacement, two different types of fuel injection systems emerged. One consisted of a fuel injector or fuel metering unit that relied on a separate constant pressure pump to supply fuel to the injector. Since the metering (regulating) was done at the injector, the fuel pressure required was not critical as long as the pump could provide a specific range of pressures. For example, if the injector had a 20 psi requirement, 23-30 psi pump pressure was

acceptable because the fuel pressure on the outlet side of the injector was 20 psi. But, if the pressure out of the pump fell below 20 psi, the injector would fail to provide adequate fuel to the engine.

The second type of fuel injection system used a fuel pump in which pressure was proportional to engine RPM. This pump is still referred to as a speed-sensing integral fuel pump. Any change in pump pressure resulted in a change in engine operation.

Regulatory interpretation resulted in confusion over what was acceptable for fuel pressure monitoring, including the requirements for the content of indicated information and the pressure pick-up location. Some installations utilizing the constant pressure pump were required to have a pressure indicator measuring unmetered fuel pressure at the fuel pump output. On the other hand, installations using the speed-sensing integral pump system were approved with a fuel pressure indicator measuring metered fuel pressure at the fuel distribution valve. Airplanes utilizing this system have a fuel pressure indicator labeled in fuel used per hour or fuel flow. Agency policy, briefing paper from Central Region dated October 7, 1981, accepted these fuel pressure indicators as an equivalent means of compliance if the engine was certificated with an integral speed-sensing pressure pump.

The Aircraft Owners and Pilots Association (AOPA) petitioned the FAA for new standards that would allow, on all pump-fed engines, a fuel flow system employing a differential pressure transducer to be accepted as an equivalent means of compliance to the current fuel pressure indicator requirements (55 FR 39299; September 26, 1990). The AOPA believes that adopting its petition would open the door for the development of new and valuable engine monitoring equipment, while potentially reducing the instrument panel clutter.

In its petition, the AOPA states that one of the reasons for current § 23.1305(b)(4) is to give the pilots sufficient warning of any decreasing trend that could lead to partial or total engine failure. The AOPA also states that differential pressure indicators should be accepted as a means of compliance with § 23.1305(b)(4), not that direct sensing systems should be removed from part 23.

Following receipt of the AOPA's petition for rulemaking, the FAA requested that the Aviation Rulemaking Advisory Committee (ARAC) review the petition and recommended a course of action to the FAA. The ARAC was chartered in February 1991, under the Federal Advisory Committee Act, to provide recommendations to the FAA Administrator on FAA rulemaking activity relating to aviation safety issues.

In January 1992, the Fuel Indicators Working Group of the ARAC on General Aviation and Business Airplane Issues began review of the AOPA's petition. Subsequently, the ARAC, recommended that the FAA revise the certification standards for fuel pressure indicators. The ARAC agreed with the AOPA's petition to allow a pressure-based fuel flow system, but felt that there may be other options in the future, and that the AOPA's language regarding a differential pressure transducer would be too restrictive. Technical advances in the automobile industry with engine systems and controls may offer improvements over the current warning systems. The ARAC did not want the proposed rule to be limited to a fuel pressure or pressure-based fuel flow gauge.

General Discussion of the Proposals

Section 23.1305

The intent of the fuel pressure indicator requirement for pump-fed engines is to advise the pilot of a fuel pressure deficiency before total engine failure. The term "indicator" in § 23.1305(b)(4) implies that the fuel pressure be constantly displayed.

This proposal would change the current requirements in that a fuel pressure indicator or a fuel flow indicator would be acceptable. The fuel flow indicator would constantly display information that the pilot could use to evaluate engine power, fuel mixture, and other engine performance factors. Furthermore, it is technologically possible to have a microprocessor that monitors engine operation and triggers a warning if the fuel system operation does not match the other monitored engine trends. Therefore, this proposal would also change the rule to accept a means that monitors the fuel system and warns the pilot of any trend that could lead to engine failure.

Accordingly, this proposal would adopt a performance standard, instead of a requirement for specific equipment. In this way, the designer could show compliance with paragraph (b) of the proposal by developing any design that monitors the fuel system and warns the pilot of any trend that could lead to engine failure. The ARAC did not believe this would reduce the level of safety originally intended by the requirement. A warning light system could possibly alert the pilot sooner than if the pilot relied on an instrument panel scan to notice a trend in the fuel pressure indication.

Microprocessing units that monitor engine operation and warn of fuel system problems have already been incorporated in transport aircraft and automobiles. Furthermore, pilots are not monitoring gauges like they use to; instead, they are increasingly relying on warnings to alert them. Late model automobiles, computers and other equipment are designed to protect the operators from mistakes by using built-in warnings. It is important to note that this NPRM does not propose to allow "idiot lights" to replace fuel pressure gauges. A light that comes on at the same time that the engine quits is useless. A warning light system that would comply with this proposal would be sophisticated enough to read transients and trends, and would give a useful warning to the pilot. The FAA expects this proposal to result in fuel systems that provide the pilot with useful engine operating information; thereby, it would offer more value to the operator.

Today, fuel pumps are more reliable than those built in the 1940's and 50's. Consequently, airplane operators are more concerned about reducing engine operating costs than they are about the probability of a fuel pump failure.

A fuel flow indicator offers additional value compared to a fuel pressure indicator. It enables the operator to monitor the engine's fuel consumption and compare it to fuel consumption listed in the airplane flight manual. If a fuel monitoring system is installed that automatically controls the engine or helps the pilot to properly lean the fuel mixture, then engine operation would be optimized and the direct operating costs would go down through reduced fuel consumption. Reciprocating engines run better if the fuel to air mixture is leaned out according to the optimum (manufacturer's) specified setting. Furthermore, fuel flow also relates to power, and pilots can use fuel flow readings to quickly assess the health of their engine during critical phases of flight, such as takeoff.

Comprehensive engine monitors and redesigned electronic engine instrument displays are also being used in experimental aircraft. The FAA should encourage airplane manufacturers to utilize new technology to improve operation and reduce operating costs. New engine monitoring systems may improve reliability and engine life, resulting in increased safety.

The proposal would achieve the same safety objective as the current rule; the crew would have sufficient warning of any negative trend that could lead to

partial or total engine failure. However, the proposal recognizes that this objective can be achieved by measuring fuel pressure, fuel flow, or with a "smart" fuel monitoring system.

International Compatibility

The agency has reviewed corresponding International Civil Aviation Organization international standards and recommended practices and Joint Aviation Authorities requirements for compatibility.

Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1990 (44 U.S.C. 3501 *et seq.*), there are no reporting or recordkeeping requirements associated with this proposed rule.

Regulatory Evaluation Summary

Proposed changes to federal regulations must undergo several economic analyses. First, Executive Order 12866 directs Federal agencies to promulgate new regulations or modify existing regulations only if the potential benefits to society outweigh the potential costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory change son small entities. Finally, the Office of Management and Budget directs agencies to assess the effects of regulatory change son international trade. In conducting these analyses, the FAA has determined that this rule: (1) Would generate benefits exceeding its costs and is not significant as defined in Executive Order 12866; (2) is not significant as defined in DOT's Policies and Procedures; (3) would not have a significant economic impact on small entities; and (4) would not affect international trade. These analyses, available in the docket, are summarized below.

Cost-Benefit Analysis

Since the proposed rule would permit but not require alternative means of warning pilots of fuel system problems, it is inherently cost-beneficial. To the extent that it would encourage the development and utilization of comprehensive engine control, monitoring and diagnostic systems in the future, it would contribute benefits in the form of enhanced safety, improved fuel efficiency, power output, and engine life.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by government regulations. The RFA requires a Regulatory Flexibility Analysis if a rule would have a significant economic impact, either detrimental or beneficial, on a substantial number of small entities. Based on criteria in FAA Order 2100.14A, Regulatory Flexibility Criteria and guidance, the FAA has determined that the proposed rule would not have a significant economic impact on a substantial number of small manufacturers or operators.

International Trade Impact Assessment

The proposed rule would not constitute a barrier to international trade, including the export of U.S. airplanes to foreign markets or the import of foreign airplanes into the United States.

Federalism Implications

The regulations proposed herein would not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12866, it is determined that this proposal would not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

The FAA proposes to amend the airworthiness standards to allow airplane manufacturers to utilize new technology for fuel system monitoring to improve the operation and economy of part 23 airplanes powered by pump-fed engines. The current requirements provide for a fuel pressure indication; it, thus, limits the means of compliance. The advances in automobile engine monitoring systems and electronics offer technology that should be utilized by the aviation community. By broadening this airworthiness standard, fuel flow indicators or new fuel system monitors may be utilized that will provide more useful information to the pilot.

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this proposed regulation is not significant under Executive Order 12866. In addition, the FAA certifies that this proposal, if adopted, will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. This proposal is not considered significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). An initial regulatory evaluation of the proposal, including a Regulatory Flexibility Determination and Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under **FOR FURTHER INFORMATION CONTACT.**

List of Subjects in 14 CFR Part 23

Aircraft, Air transportation, Aviation safety, Safety.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend part 23 of the Federal Aviation Regulations (14 CFR part 23) as follows:

PART 23—AIRWORTHINESS STANDARDS; NORMAL, UTILITY, ACROBATIC, AND COMMUTER CATEGORY AIRPLANES

1. The authority citation for part 23 continues to read as follows:

Authority: 49 U.S.C. 1344, 1354(a), 1355, 1421, 1423, 1425, 1428, 1429, 1430; 49 U.S.C. 106(g).

2. Section 23.1305 is amended by revising paragraph (b)(4) to read as follows:

§ 23.1305 Powerplant instruments.

* * * * *

(b) * * *

(4) For each pump-fed engine, a means:

(i) That continuously indicates, to the pilot, the fuel pressure or fuel flow; or

(ii) That continuously monitors the fuel system and warns the pilot of any trend that could lead to engine failure.

* * * * *

Issued in Washington D.C. on December 21, 1994.

Elizabeth Yoest,

Acting Director, Aircraft Certification Service.

[FR Doc. 94–31913 Filed 12–27–94; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No. 28011; Amendment No. 23–52]

RIN 2120–AF41

Powerplant Instruments; Fuel Pressure Indication

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This document amends the certification requirement for fuel pressure indicators on pump-fed engines of normal, utility, acrobatic, and commuter category airplanes to permit regulatory alternatives to fuel pressure indicators to warn pilots of fuel system problems. A fuel pressure indicator is not technically the only means available to the pilot of indicating a fuel system problem. The amendment allows airplanes to be certificated with a means that indicates fuel flow or that monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure. New technology incorporated as a means of compliance with the revised rule could improve engine operation and reduce airplane operating costs.

EFFECTIVE DATE: July 25, 1996.

FOR FURTHER INFORMATION CONTACT: J. Lowell Foster, Aerospace Engineer, Standards Office, Small Airplane Directorate, Aircraft Certification Service, Federal Aviation Administration, 601 East 12th Street, Kansas City, Missouri 64106; telephone (816) 426–5688.

SUPPLEMENTARY INFORMATION:

Background

Statement of the Problem

The FAA proposed to amend Title 14 of the Code of Federal Regulations (CFR), Part 23, § 23.1305(b)(4), which required a fuel pressure indicator for each pump-fed engine. The pressure indicator gives continuous fuel pressure readings to the pilot. This information provides an advance warning of engine failure only when a pilot notices the pressure reading has deviated from the norm and when the pilot can diagnose what those deviations mean in terms of potential engine failure. The change would allow the options of a fuel pressure indicator, a fuel flow indicator, or a means that continuously monitors the fuel system and warns the pilot of any fuel flow trend that could cause engine failure. A fuel flow indicator would give continuous fuel flow readings to the pilot. Fuel flow information presents the fuel system status to the pilot in a manner similar to the fuel pressure indicator, but it also allows the pilot to quickly assess the engine's performance during critical phases of flight, such as takeoff. A continuous fuel system monitoring device would alert the pilot to any fuel flow trend that could lead to engine failure.

History

The Aircraft Owners and Pilots Association (AOPA) petitioned the FAA for new standards that would allow, on all pump-fed engines, a fuel flow system employing a differential pressure transducer to be accepted as a means of compliance equivalent to the current fuel pressure indicator requirements (55 FR 39299, September 26, 1990). The FAA requested that the Aviation Rulemaking Advisory Committee (ARAC) review the petition and recommend a course of action. In January 1992, the Fuel Pressure Indicators Working Group of the ARAC on General Aviation and Business Airplane Issues began a review of the AOPA's petition. As a result of the review, a Notice of Proposed Rulemaking (NPRM), Notice No. 94–37, was published on December 28, 1994 (59 FR 67114).

Discussion of Comments

General

This amendment is based on the NPRM, Notice No. 94–37, published December 28, 1994 (59 FR 67114). Interested persons were invited to participate in the development of this final rule by submitting written data, views, or arguments to the regulatory docket on or before February 27, 1995. Four comments were received on the proposal, including a letter of support from the Air Line Pilots Association.

The intent of the fuel pressure indicator requirement for pump-fed engines is to advise the pilot of a fuel pressure deficiency before total engine failure. The term "indicator" in § 23.1305(b)(4) implies that the fuel pressure be constantly displayed.

The FAA proposed a change to allow a fuel pressure indicator or a fuel flow indicator. The fuel flow indicator would constantly display information that the pilot could use to evaluate engine power, fuel mixture, and other engine performance factors in addition to fuel system status. It is technologically possible to have a microprocessor that monitors engine operation and triggers a warning if the fuel system operation does not match the other monitored engine trends; therefore, the FAA also proposed to change the rule to accept a means that monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure.

Accordingly, the FAA proposed to adopt a performance standard, instead of a requirement for specific equipment. An applicant could show compliance with paragraph (b) of the proposal by using any design that monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure.

Discussion of Comments to Section 23.1305

One commenter, a private individual, does not feel that § 23.1305(b)(4) should be changed as proposed. The commenter believes that "an accurate indication is necessary for the pilot to have a situation awareness of his operating environment." The FAA understands and agrees with the overall basis for the comment; however, the FAA does not agree with all of the commenter's arguments and will address them individually.

First, the commenter believes the proposal implies that small airplane engines are "antiquated" using "antiquated fuel flow means." The NPRM sections discussing the history of this rule focused on fuel pump reliability, radial engines, and diagnosing fuel pump failures, which were more frequent in the 1940's and 1950's than today. The FAA's intention in discussing the rule's history was to point out that the reliability of fuel pumps has improved since the 1940's. The FAA did not intend to imply that these engines were in some way "antiquated." In fact, as the commenter points out, the basic engines used on most small airplanes are derivatives of the engines designed in the 1940's. Civil Air Regulation 3 airplanes, which constitute over 85 percent of the existing small airplanes flying today, have an excellent service history.

The commenter also points out that "continual reference to automobile monitoring systems is well taken, except that automobiles can have a problem and pull off to the side of the road." Additionally, "[a]utomobiles may have indicator lights and warnings as to the state of fule consumption, but they also have a fuel quantity gauge so the driver can monitor the system in use to also determine an accurate fuel flow." The FAA used the reference to automobile technology to make the point that sophisticated engine monitoring is inexpensive enough to be mass produced for automobiles. Complex fuel

monitoring systems are available in business jets and recently-certificated jet transport aircraft. This technology may soon be affordable to small airplane owners and manufacturers, and the FAA does not want to impede progress with rules offering no alternatives.

The commenter believes that the proposal would allow "idiot lights." On the contrary, the FAA stated in the NPRM, "A light that comes on at the same time that the engine quits is useless. A warning light system that would comply with this proposal would be sophisticated enough to read transients and trends, and would give a useful warning to the pilot." Also, the rule as proposed would require that any warning light system continuously monitor the fuel system and warn the pilot of any fuel flow trend that could lead to an engine failure.

Transport Canada questions the ability to show compliance with the requirement in § 23,1549 to identify maximum and, if applicable, minimum safe operating limits as well as the normal operating range of the instrument. This commenter points out that the typical fuel flow meter is a digital type, and it would be difficult for the applicant to provide equivalent markings, Engine manufacturers provide the information required by § 23.1549, which is then usually transcribed to the installed fuel pressure gauge. It appears that this information would not be presented through the use of typical digital fuel flow meters. The commenter offers the following suggestion: "FAR 23.1549 was written with a traditional dial instrument in mind where the engine limitations could be easily displayed on the face of the unit and monitored by the crew. To allow flow meters or other fuel system monitors to satisfy the requirements of § 23.1549 where such a gauge no longer exists, compliance could be shown by (1) different colors to indicate changing trends in system performance (e.g., amber color for a low pressure/flow condition, red for impending engine failure), or (2) placarding, if appropriate, to indicate the normal and abnormal operating ranges."

The FAA agrees with the commenter's suggestions as an acceptable means of compliance with § 23.1549. Suggested items (1) and (2) above offer the pilot a means to determine fuel flow limitations, which may be needed if a fuel flow meter is installed.

A commenter from Australia supports the proposal; however, the commenter feels that the proposed text would require a monitoring system that provides a warning of any trend that could lead to engine failure, which is an extremely difficult compliance requirement. The commenter further states: "The historic requirement, and the NRPM preamble, clearly addresses fuel pressure (as an indication of the availability of fuel flow) or fuel flow only. Such wording may stifle the development of monitoring instrumentation for small airplanes." The commenter suggests that, for clarification, the proposed text for § 23.1305(b)(4)(ii), be amended to read as follows: "That continuously monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure."

The FAA agrees with the commenter that the proposed wording may be too broad, making compliance difficult or the system unnecessarily complex. The FAA encourages "smart" systems; however, the intent of the proposal was to warn the pilot of any fuel flow trend and, for that reason, the final rule and the preamble adopt the commenter's language.

Section 23.1305 is adopted with the change in paragraph (b)(4)(ii) to add the words "fuel flow" before the word "trend."

International Compatibility

The agency has reviewed corresponding International Civil Aviation Organization international standards and recommended practices and Joint Aviation Authorities requirements for compatibility. The FAA has determined that this final rule, if adopted, would not present any differences.

Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1990 (44 U.S.C. 3501 et seq.), there are no reporting or recordkeeping requirements associated with this rule.

Regulatory Evaluation Summary

Economic Evaluation, Regulatory Flexibility Determination, and Trade Impact Assessment

Proposed changes to federal regulations must undergo several economic analyses. First, Executive Order 12866 directs Federal agencies to promulgate new regulations or modify existing regulations only if the potential benefits to society outweigh the potential costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Finally, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this rule: (1) will generate benefits exceeding its costs and is not significant as defined in Executive Order 12866; (2) is not significant as defined in DOT's Policies and Procedures; (3) will not have a significant economic impact on small entities; and (4) will not affect international trade. These analyses, available in the docket, are summarized below.

Economic Evaluation

The rule adopts a performance standard instead of requiring specific equipment. In this way, manufacturers can develop any design that monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure. The objective of imposing a performance standard could be met in this case by any means that "continuously indicates to the pilot fuel pressure or fuel flow, or that continuously monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure." This will maintain the level of safety intended by the original requirement, without imposing any additional costs. For example, a warning light system could possibly alert the pilot sooner than if the pilot relied on an instrument panel scan to notice a trend in the fuel pressure indication alone (as is currently the case).

A fuel flow indicator offers additional benefits compared to a fuel pressure indicator in that it enables the pilot to monitor the engine's fuel consumption and compare it to fuel consumption listed in the airplane flight manual. Consequently, engine operation could be improved, resulting in reduced fuel consumption and operating costs. In addition, continual fuel flow readings are useful during critical phases of flight, such as takeoff and climb. Thus, flight safety could be enhanced. The other alternative, a means to continuously monitor the fuel system, will also enhance safety by alerting the pilot to any fuel flow trend that could lead to engine failure.

Since the rule will permit but not require alternative means of warning pilots of fuel system problems, it is inherently cost-beneficial. To the extent that it encourages the future development and utilization of comprehensive engine control, monitoring, and diagnostic systems, it will generate benefits in the form of enhanced safety, improved fuel efficiency, power output, and engine life.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by government regulations. The RFA requires a Regulatory Flexibility Analysis if a proposed or final rule would have a significant economic impact, either detrimental or beneficial, on a substantial number of small entities. FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, prescribes standards for complying with RFA requirements in FAA rulemaking actions. The Order defines "small entities" in terms of size, "significant economic impact" in terms of annualized costs, and "substantial number" as a number which is not less than eleven and which is more than one-third of the small entities subject to a proposed of final rule.

The rule will affect manufacturers of future part 23 airplanes. For manufacturers, Order 2100.14A defines a small entity as one with 75 or fewer employees and a significant economic impact as annualized costs of $19,000 or more. The FAA has determined that the rule will not have a significant economic impact on a substantial number of small manufacturers since the annualized certification costs of the rule are less than $19,000.

International Trade Impact Assessment

The rule will not constitute a barrier to international trade, including the export of U.S. airplanes and airplane parts to foreign markets or the import of foreign airplanes and airplane parts in the United States.

Federalism Implications

The regulations herein will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this regulation will not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

The FAA amends the airworthiness standards to allow airplane manufacturers to utilize new technology for fuel system monitoring to improve the operation and economy of part 23 airplanes powered by pump-fed engines. The current rule requires a fuel pressure indication; thus, it limits the means of compliance. The advances in engines monitoring systems and electronics offer technology that should be utilized by the aviation community. By broadening this airworthiness standard, fuel flow indicators or new fuel system monitors may provide better information to the pilot.

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this regulation is not significant under Executive Order 12866. In addition, the FAA certifies that this regulation will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. The regulation is not considered significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). A regulatory evaluation of the regulation, including a Regulatory Flexibility Determination and Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under **FOR FURTHER INFORMATION CONTACT.**

List of Subjects in 14 CFR Part 23

Aircraft, Aviation safety, Signs and symbols.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends 14 CFR part 23 as follows:

PART 23—AIRWORTHINESS STANDARDS; NORMAL, UTILITY, ACROBATIC, AND COMMUTER CATEGORY AIRPLANES

1. The authority citation for part 23 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44704.

2. Section 23.1305 is amended by revising paragraph (b)(4) to read as follows:

§ 23.1305 Powerplant instruments.

* * * * *

(b) * * *

(4) For each pump-fed engine, a means:

(i) That continuously indicates, to the pilot, the fuel pressure or fuel flow; or

(ii) That continuously monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure.

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David R. Hinson,

Administrator.

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